Synthesis and properties of $Tb_xLa_{1-x}InO_3$ ($x \leq 0.15$) indates

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In present work $Tb_xLa_{1-x}InO_3$ solid solutions with $x = 0.03, 0.05, 0.07, 0.15$ were synthesized by the ceramic method and their crystal structure, thermal expansion and thermal stability, magnetic susceptibility, IR-spectra, excitation and photoluminescence spectra were investigated.

It was found that in $TbInO_3 – LaInO_3$ binary system with $x \leq 0.15$ there was a continuous range of $Tb_xLa_{1-x}InO_3$ solid solutions with the structure of orthorhombically distorted perovskite.

IR-spectra of the samples investigated were found to be almost coequal.

Average coefficients of linear thermal expansion for the ceramic samples of $Tb_xLa_{1-x}InO_3$ solid solutions depend insignificantly on the substitution degree of Tb^{3+} ions by La^{3+} ions and vary without certain dependence from $8.11 \cdot 10^{-6}$ K^{-1}, to $10.53 \cdot 10^{-6}$ K^{-1}. When heating $Tb_xLa_{1-x}InO_3$ samples up to 1273 K no thermal effects were observed, total weight loss varied from 0.1325 to 0.3254 wt. % without a certain dependence on substitution degree x

It was found that significant magnetic dilution of paramagnetic Tb^{3+} ions by diamagnetic La^{3+} ions leads to a decrease in effective spin-orbital magnetic moment of Tb^{3+} ions. This could be explained by an increase in «partial freezing» of orbital magnetic by crystal field of orthorhombically distorted perovskite.

It was found that $Tb_{0,07}La_{0,93}InO_3$ and $Tb_{0,15}La_{0,85}InO_3$ samples possess the highest photoluminescence intensity among all the $Tb_xLa_{1-x}InO_3$ solid solutions investigated (unlike it had been stated in [1]) and so they are established to be effective phosphors with visible green emission, hence, prospective for white LEDs (Fig.).

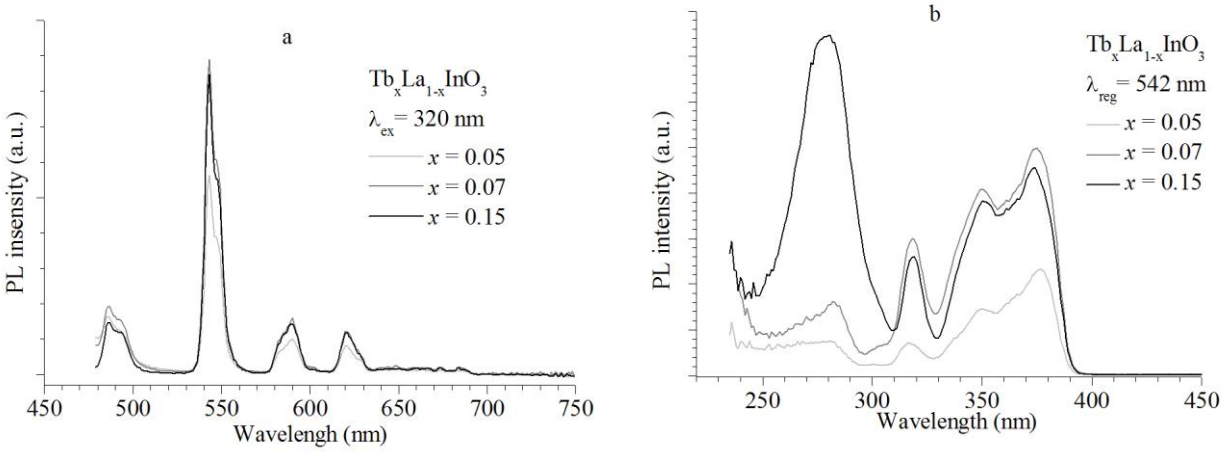

Fig. Excitation (a) and emission (b) spectra of $Tb_xLa_{1-x}InO_3$ solid solutions with $x = 0.05, 0.07, 0.15$

References

1. X. Liu, J. Lin *Solid State Science* (2009) 2030.